


Reference No.: 46
Barite Hill/Nevada Goldfields
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Preliminary Assessment/Site Inspection
Barite Hill/Nevada Goldfields
McCormick County
SCD 987 597 903

December 15, 2006
Prepared By: Timothy Kadar 
Reviewed By: Jonathan McInnis
Site Assessment Section
Bureau of Land & Waste Management
South Carolina Department of Health & Environmental Control
2600 Bull Street
Columbia, SC 29201

I. SCOPE OF WORK

Under authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), the Site Assessment Section of the South Carolina Department of Health and Environmental Control (SCDHEC) conducted a Preliminary Assessment/Site Inspection of the Barite Hill/Nevada Goldfields site in McCormick County, South Carolina. The scope of the investigation included a review of available file information, a site reconnaissance, a sampling trip, and a target survey. As part of this investigation, 12 surface water samples and 17 soil/sediment samples were collected from onsite and off-site surface waters, soils, and sediments. The primary objective of this investigation was to determine the site's potential impact to the surface water pathways associated with the site.

II. INTRODUCTION

The Barite Hill/Nevada Goldfields site is located approximately 3 miles south of McCormick, South Carolina between US 378 and US 221 on the northern side of Road 30 in McCormick County, South Carolina. The mine site is relatively remote; there are no buildings, homes, or commercial buildings within 0.5 miles of the boundary. The site actively mined gold from 1991 to 1995. From 1995 until Nevada Goldfields filed for Chapter 7 Bankruptcy in 1999, the reclamation of the site was being addressed by Nevada Goldfields. On July 7, 1999 Nevada Goldfields handed the facility's keys to SCDHEC and abandoned the site.

The site is located along a topographic high ridge area forming the headwaters of an unnamed tributary to Hawes Creek. The topography of the area consists of rolling hills with ridgelines at an elevation of about 500 feet. Within the site, the ridgeline comprising the site has a high point of about 510 feet and an average elevation of approximately 480 feet.

The permitted mine site totals 795.2 acres. Of this total, 659.7 acres are designated as buffer area (areas not disturbed beyond the pre-mine natural state); therefore the maximum disturbance area is 135.5 acres.

The facility used a cyanide solution in a heap leach process to extract gold from ore. There are 7 processing ponds onsite containing an unknown amount of free-liquids. Three large, multi-acre, waste rock piles contaminated with cyanide are left onsite. Each waste rock pile has the potential for producing acid. Storm water run on and runoff are not controlled at the site. The Main Pit from the mining operations remains. The pit contains approximately 100 million gallons of water with a pH of 2 ~ 2.2 and a high dissolved metal content. Seeps from the main pit containing acidic water with high dissolved metal content is being released to the northern unnamed tributaries of Hawes Creek which borders the pit.

A SI was conducted on December 8, 2003, which included surface water and sediment samples. Instrumentation interference caused by high concentrations of metals in the samples adversely

affected the data quality of the results. The site was re-sampled as an ESI on the week of September 26, 2004. ESI sample results for surface water, sediments, and soils detected several elevated metals (arsenic, cobalt, copper, cyanide, iron, lead, manganese, selenium, and zinc) both on-site and offsite.

In addition to the surface water, sediment, and on-site soil samples, portions of the site were screened utilizing a field portable InnovX XL440 XRF. XRF screening results for the on-site soils samples detected several elevated metals (arsenic, cobalt, copper, lead, selenium, and zinc) in the former asphalt leach pad area.

The main pit contains approximately 100 million gallons of water with a high metal loading content and a pH of 2 to 2.2 standard units.

III. SITE BACKGROUND AND HISTORY

Ownership History

The Barite Hill/Nevada Goldfields site mined gold from 1991 to 1994 and silver from 1991 to 1992. Nevada Goldfields filed Chapter 7 Liquidation with the United States Bankruptcy Court, District of Delaware on June 25, 1999. They abandoned the site on July 7, 1999 (Ref. 5, 6, 7).

The disturbed area of the Barite Hill/Nevada Goldfields site is currently divided into three parcels of land (Ref. 3, 8).

Property Description: McCormick County Tax Maps
128-000-00-005, 148.1 acres
128-000-00-004, 55.7 acres
128-000-00-003, 43.59 acres

Current Owner of site: Tax Map 128-000-00-005
Gwalia (USA) Ltd.
PO Box 1530
McCormick, SC 29835

Pete K. Lalor – Gwalia in 1998 (no longer on the Board)
38-40 Parliament Place
West Perth
Western Australia 6005

Represented by: CT Corp System (last known Registered Agent – 1998)
75 Beattie Place, Two Shelter Centre
Greenville, SC 29602

Corporation Information:
(Currently Active) Gwalia Resources (International) Limited
38-40 Parliament Place
West Perth, PO Box 669
West Perth
Western Australia 6005

History: Gwalia (USA) Ltd acquired this parcel via sale and land swap
with Bowater (Catawba Timber).

Current Owner of site: Tax Map 128-000-00-004
Gwalia (USA) Ltd.
PO Box 1530
McCormick, SC 29835

Pete K. Lalor – Gwalia in 1998 (no longer on the Board
38-40 Parliament Place
West Perth
Western Australia 6005

Represented by: CT Corp System (last known Registered Agent – 1998)
75 Beattie Place, Two Shelter Centre
Greenville, SC 29602

Corporation Information:
(Currently Active) Gwalia Resources (International) Limited
38-40 Parliament Place
West Perth, PO Box 669
West Perth
Western Australia 6005

History: Gwalia (USA) Ltd acquired this parcel from the U.S. Forest
Service via Exchange Deed.

Current Owner of site: Tax Map 128-000-00-004
Rainsford & Sons, A General Partnership, c/o Benjamin Rainsford
25 Cantelou Road
Edgefield, SC 29824

History: The property has been owned by Rainsford & Sons since 1975.

Pertinent Regulatory Activity

SCDHEC Permits – Permit to Construct (No. 17,334-IW), 7-24-92; Permit to Operate, 9-28-1992; Permit to Operate, 3-1-1993; NPDES (No. SC0043401), 10-12-1989, Air Quality Permit (No. 1600-0006-CA, CB, CC, CD, and CE, 6-12-1990.

SCRLRCC Permit – Permit for Mining Operation (No. 0852), 8-14-1990.

SCDHEC Notice of Violation (NOV), (each date is a separate notice) 8-25-95, 6-27-96, 10-30-1996, and 3-11-1997.

SCDHEC Consent Order 98-049-W, 6-11-1998

Description and Setting

The Barite Hill/Nevada Goldfields site is located approximately 3 miles south of McCormick, in McCormick County, South Carolina. Strom Thurmond Lake on the Savannah River is approximately 3 miles west of the site. The mine site is relatively remote; there are no buildings, homes, or commercial buildings within 0.5 miles of the boundary (Ref. 3, 9, 10).

The site is located along on a topographic high ridge area forming the headwaters of an unnamed tributary to Hawes Creek. The topography of the area consists of rolling hills with ridgelines at an elevation of 500 about feet. Within the site, the ridgeline comprising the site has a high point of about 510 feet and an average elevation of approximately 480 feet (Ref. 3, 9, 10).

The permitted mine site totals 795.2 acres. Of this total, 659.7 acres are designated as buffer area (areas not disturbed beyond the pre-mine natural state); therefore the maximum disturbance area is 135.5 acres (Ref. 3, 9).

The facility used a cyanide solution in a heap leach process to extract gold from ore. There are 7 processing ponds onsite containing an unknown amount of free-liquids potentially contaminated with cyanide. Three large, multi-acre, waste rock piles contaminated with cyanide are left onsite. Each waste rock pile has the potential for producing acid. Storm water run on and runoff are not controlled at the site. The Main Pit from the mining operations remains. The pit contains approximately 100 million gallons of water with a pH of 2 ~ 2.2 and the probability of a high dissolved metal content. Runoff from the site could contain a cyanide bearing solution or acidic water with high dissolved metal content. This runoff could be impacting wetlands and the unnamed tributaries of Hawes Creek that surround the site (Ref. 3, 9, 10, 11, 12).

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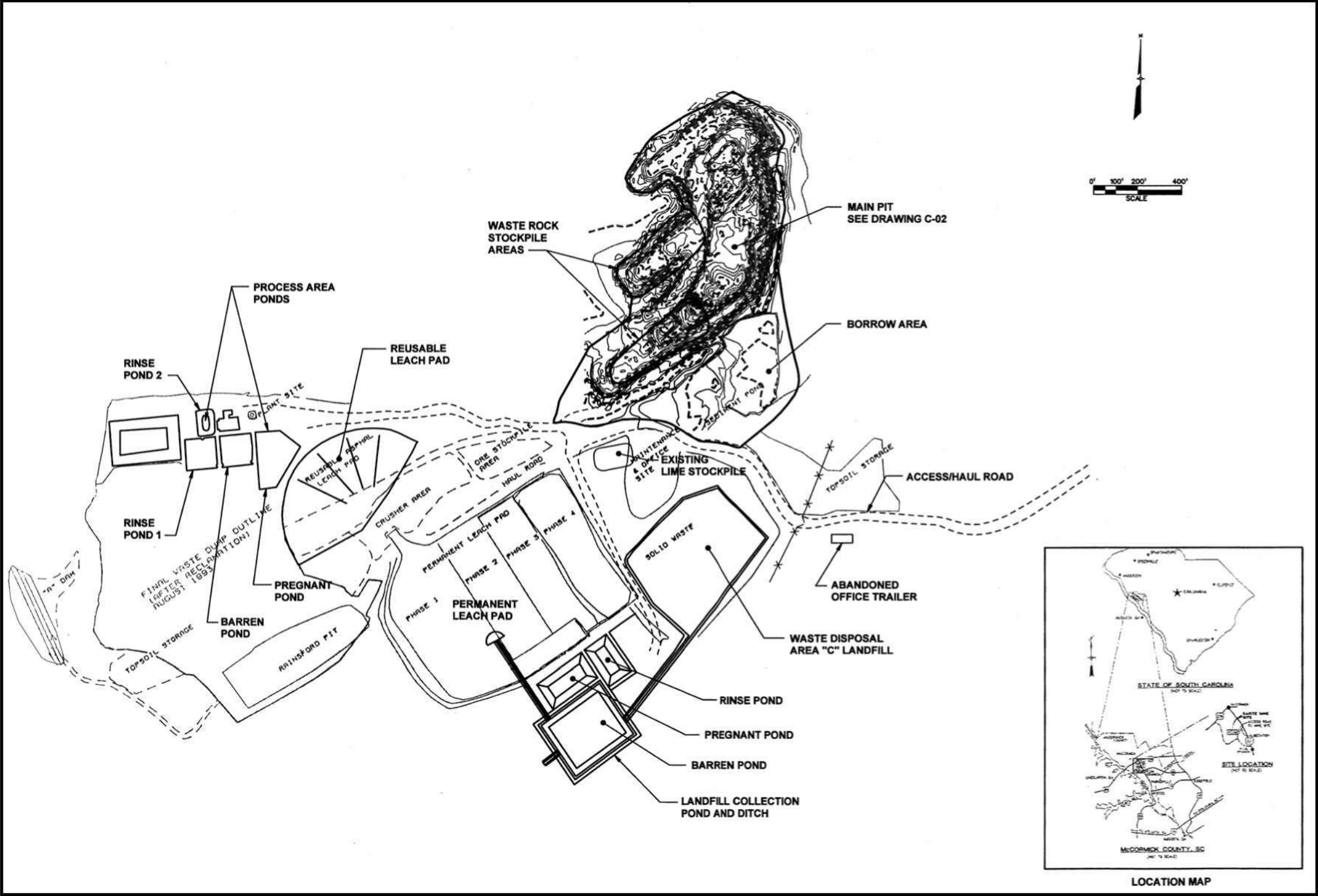


Figure 1 - General Site Layout

Process and Waste Disposal History

The ore was mined using conventional open pit methods. Rock was first fractured using drilling and blasting, and then loaded into haul trucks by diesel-powered front-end loaders. Waste rock was then hauled and used as fill for facility construction or hauled and dumped in the waste rock disposal areas. Ore was hauled to the crushing area where processing for the cyanide heap-leach method began. The ore was crushed to minus 3/4-inch and agglomerated with cyanide and cement. The crushed and agglomerated ore was then placed on pads using a conveyor and radial stacker system. A dilute cyanide solution was then sprayed over the heaps and allowed to percolate through the ore, thereby dissolving the gold into solution (Ref. 9, 10, 14).

The gold bearing (or pregnant) solution from the pads drained from the bottom of the heaps and was routed either to the process plant, or returned to the heaps to increase the solution's gold content. At the process plant, gold recovery from the process solution began by the adsorption of the dissolved gold onto activated carbon. The loaded carbon was then stripped by an electrowinning process. Electro-deposited gold was then melted to form dore' bars which were shipped offsite for further refining (Ref. 9, 10, 14).

The solution, once stripped of its gold content, was termed 'barren' solution. This solution was recharged to the proper cyanide concentration and recycled back into the leaching circuit. Barren solutions not recycled (waste solutions) were initially treated with calcium hypochlorite followed by secondary treatments to reduce cyanide and copper concentrations before being discharged into the Little Fork Creek. After the completion of an expanded wastewater treatment facility, the primary treatment for waste solutions was changed to hydrogen peroxide (Ref. 9, 10, 12, 13, 14).

Before Nevada Goldfields ceased reclamation activities at the site on July 7 1999, the pH of the water in the Main Pit was raised to 11 standard units through the addition of lime. During a SCDHEC site visit on November 13, 2003, the water in the Main Pit was determined to have a pH of between 2 to 2.2 standard units. The condition of the Main Pit at the Barite Hill/Nevada Goldfields site is of the utmost concern. Because of sulfide waste rock, the water quality of the pit is adversely impacting the groundwater and the surface waters around the site (Ref. 6, 7, 15).

The Main Pit represents the greatest potential for adverse impacts to the environment surrounding the Barite Hill/Nevada Goldfields site. However, there are other areas of concern: 1) process waters have not been treated to acceptable qualities for discharge; 2) construction of wetlands to act as passive treatment for leachate drainage from the capped leach pads and industrial waste landfills was not implemented allowing untreated leachate to reach surface water bodies; 3) concrete buildings that formerly housed the gold processing plant and associated process ponds have not been properly closed out; 4) proper maintenance of clay caps, grasslands, run on and runoff controls have been discontinued; 6) no monitoring of groundwater quality at the site; and 7) no monitoring of process water being discharged to the surface water bodies surrounding the site (Ref. 6, 7, 15).

IV. SOURCE CHARACTERIZATION

Main Pit

The majority of the ore mined at the Barite Hill/Nevada Goldfields site was extracted from the Main Pit between the years of 1990 and 1995. Active mining ceased onsite in 1995 and reclamation activities began onsite. To date, no reclamation of the Main Pit has occurred (Ref. 5, 6, 7,).

The Main Pit is located in the northeast portion of the site. The pit was excavated to the 340-foot bench (natural surface grade is at the 480-foot bench) with a total volume of approximately 1,390,000 cubic yards. The pit contains approximately 100,000,000 gallons of water with the water table being located at the 410-foot bench. The pit water's pH is less than 2.0 standard units (Ref. 5, 11, 15, 16, 17).

Both oxidized rock and sulfide rich rock remains in place along the pit walls. Several fractures, minor faults, and apparent zones of permeable rock are present along the pit high walls. Waste rock, containing as much as 30~40 percent sulfide, is stored along the southern and southwestern edges of the pit (Ref. 15, 16, 17, 18).

Table 1: Barite Hill/Nevada Goldfields
 Main Pit Water Sample
 Analyzed for TAL Metals.
 All results in ug/kg (Ref. 19)

Analyte	BH-004-SW
Silver	50 U
Arsenic	270
Barium	50 U
Beryllium	30 U
Cadmium	930
Cobalt	730
Chromium	52
Copper	160000
Molybdenum	50 U
Nickel	200
Lead	41
Antimony	5.0 U
Selenium	150
Tin	190
Strontium	200

"U" indicates analyte not detected at or above reporting limit.

Table 2: Barite Hill/Nevada Goldfields
 Main Pit Water Sample
 Analyzed for TAL Metals.
 All results in mg/kg (Ref. 19)

Analyte	BH-004-SE
Silver	1.4
Arsenic	66
Barium	210
Beryllium	0.25 U
Cadmium	0.52
Cobalt	2.2
Chromium	6.9
Copper	180
Molybdenum	4.8
Nickel	1.4
Lead	240
Antimony	1.5
Selenium	13
Tin	0.99 U
Strontium	11

"J" indicates identification of analyte is acceptable, reported value is an estimate;
 "U" indicates analyte not detected at or above reporting limit; "UJ" indicates analyte not detected at or above reporting limit, reporting limit is an estimate.

Table 1: Continued
 All results in ug/kg

Analyte	BH-004-SW
Titanium	50 U
Thallium	5.0 U
Vanadium	50 U
Yttrium	190
Zinc	22000
Total Mercury	0.20 U
Aluminium	100000
Manganese	9500
Calcium	260
Magnesium	49
Iron	420
Sodium	61
Potassium	10 U
Cyanide	10 U

"U" indicates analyte not detected at or above reporting limit

Table 2: Continued
 All results in mg/kg

Analyte	BH-004-SE
Titanium	47
Thallium	0.25 U
Vanadium	26
Yttrium	0.74
Zinc	61
Total Mercury	0.056
Aluminium	1900
Manganese	18
Calcium	92
Magnesium	350
Iron	38000
Sodium	200 U
Potassium	190
Cyanide	0.29 UJ

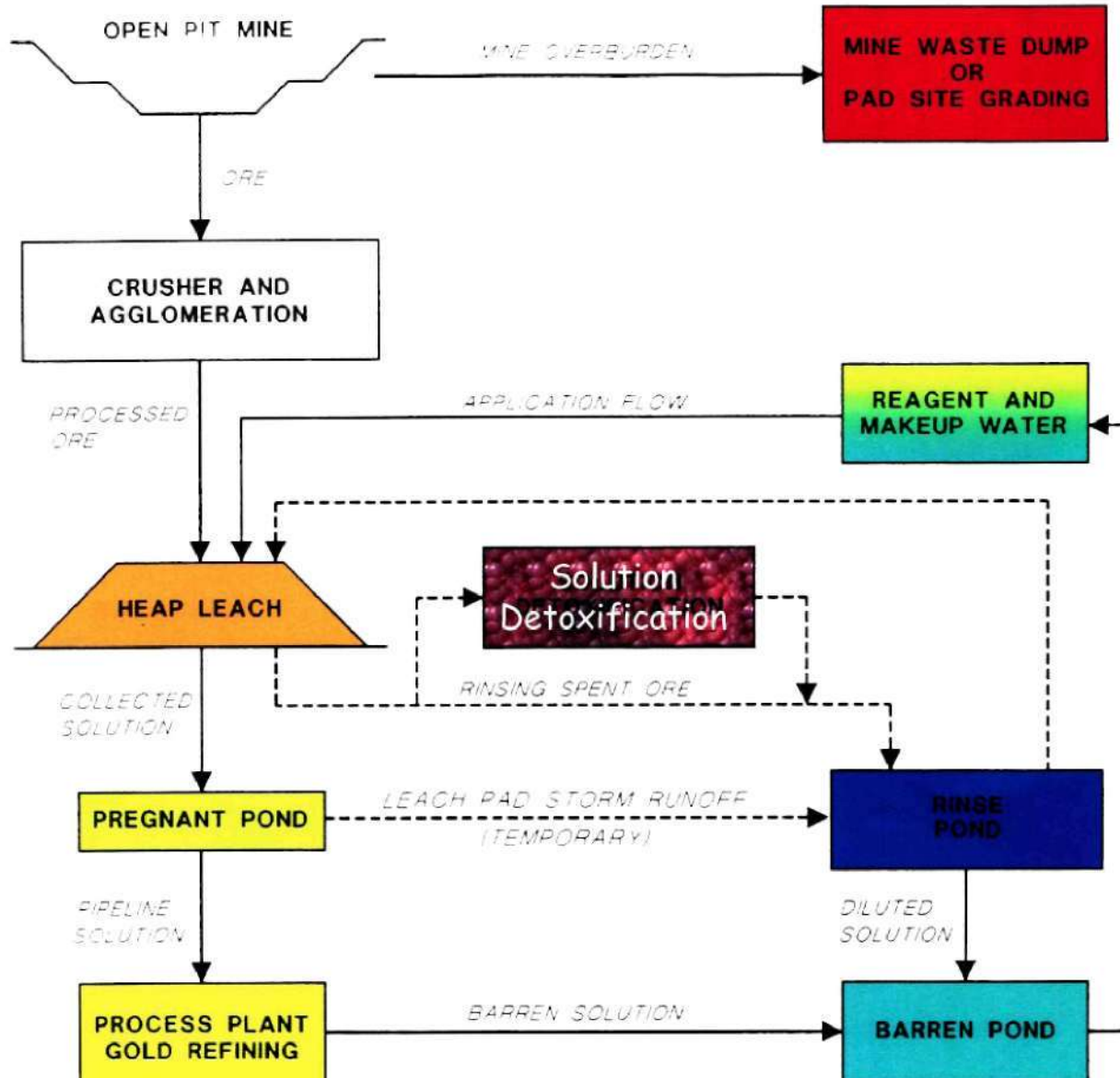
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Plant Site and Process Area Ponds

The plant area includes one metal building used to process water, a cinder block building used for offices and final gold extraction, a wood storage shed, 4 lined ponds, and 1 unlined pond. Leach/rinse solutions were routed from the leach pad by collection ditches to the pregnant pond. Water from the pregnant pond was fed to the processing plant. The gold and silver were extracted from the water and the solution was emptied into the barren pond. Barren pond water was 'refreshed' with added cyanide and applied to the heap leach pile (Ref. 3, 9, 10, 14, 16, 17, 20).

Excess heap leach water from heavy rain events, etc., was collected in the rinse ponds. The diluted water in the rinse ponds was moved to the barren pond. From the barren pond, the water would be 'refreshed' and once again applied to the heap leach pile (Ref. 9, 10, 14, 16, 17).

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Note: Leach/rinse solutions routed by collection ditch to collection ponds for recirculation or by pipelines to process plant.

Table 3 Process Area Pond Capacities	
Pond	Maximum Pond Level (gallons)
Pregnant Pond	1.73×10^6
Rinse Pond 1	7.11×10^5
Rinse Pond 2	1.55×10^5
Barren Pond	7.22×10^5

Four surface water and two sediment samples were collected from the ponds in the Plant and Process area. Sample BH-013-SW/SE was collected from the larger of the two rinse ponds. Sample BH-014-SW was collected from the smaller, northern most rinse pond. Sample BH-015-SW/SE was collected from the pregnant pond. Sample BH-016-SW was collected from the barren pond (Ref. 21, 22).

Table 4: Barite Hill/Nevada Goldfields
 Process Pond Water Samples
 Analyzed for TAL Metals.
 All results in ug/kg (Ref. 19)

Analyte	BH-013-SW	BH-014-SW	BH-015-SW	BH-016-SW
Silver	10 U	5.0 U	10 U	10 U
Arsenic	15	2.5 U	18	12 A
Barium	22	38	24	20
Beryllium	6.0 U	3.0 U	6.0 U	6.0 U
Cadmium	1.2 U	1.2 U	1.2 U	1.2 U
Cobalt	14	5.0 U	15	10 U
Chromium	10 U	5.0 U	10 U	10 U
Copper	420	10	100	94
Molybdenum	480	9.3	450	380
Nickel	190	16	240	200
Lead	2.5 U	2.5 U	2.5 U	2.5 U
Antimony	2.5 U	2.5 U	2.5 U	2.5 U
Selenium	160	5.0 U	200	90 A
Tin	30 U	15 U	30 U	30 U
Strontium	130	39	110	110

"J" indicates identification of analyte is acceptable, reported value is an estimate; "U" indicates analyte not detected at or above reporting limit; "UJ" indicates analyte not detected at or above reporting limit, reporting limit is an estimate.

Table 4: Continued

All results in ug/kg

Analyte	BH-013-SW	BH-014-SW	BH-015-SW	BH-016-SW
Titanium	10 U	5.0 U	10 U	10 U
Thallium	2.5 U	2.5 U	2.5 U	2.5 U
Vanadium	10 U	5.0 U	10 U	10 U
Yttrium	6.0 U	3.0 U	6.0 U	6.0 U
Zinc	20 U	10 U	20 U	20 U
Total Mercury	0.20 U	0.20 U	0.20 U	0.20 U
Aluminium	100 U	50 U	100 U	100 U
Manganese	47	120	43	62
Calcium	27	7.8	22	21
Magnesium	1.1	0.45	1.3	1.2
Iron	0.20 U	0.3	0.20 U	0.20 U
Sodium	760 J	77	830 J	760 J
Potassium	15	2.1	17	15
Cyanide	10 U	10 U	91	10 U

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Table 5: Barite Hill/Nevada Goldfields

Process Pond Sediment Samples

Analyzed for TAL Metals.

All results in mg/kg (Ref. 19)

Analyte	BH-013-SE	BH-015-SE
Silver	77 AJ	2.8
Arsenic	77 A	30
Barium	140 A	510
Beryllium	7.5 U	0.25 U
Cadmium	2.3 U	0.49
Cobalt	15 U	6.5
Chromium	15 U	17
Copper	24000 A	500
Molybdenum	15 U	2.7
Nickel	220 A	4
Lead	100 A	120
Antimony	1.8 AJ	1.1
Selenium	280 A	6
Tin	170 A	1.0 U
Strontium	490 A	30

"A" indicates analyte analyzed in replicate. Reported value is "average" of replicates; "J" indicates identification of analyte is acceptable, reported value is an estimate; "U" indicates analyte not detected at or above reporting limit; "UJ" indicates analyte not detected at or above reporting limit, reporting limit is an estimate.

Table 5: Continued

All results in mg/kg

Analyte	BH-013-SE	BH-015-SE
Titanium	48 AJ	62
Thallium	0.25 UJ	0.25 U
Vanadium	30 U	27
Yttrium	15 U	3.2
Zinc	460 A	52
Total Mercury	1.8	0.067
Aluminium	6000 A	4400
Manganese	110 AJ	120
Calcium	220000 AJ	5300 J
Magnesium	750 U	380
Iron	10000 AJ	26000
Sodium	6000 U	200 U
Potassium	3000 U	240
Cyanide	1700	10

"A" indicates analyte analyzed in replicate. Reported value is "average" of replicates; "J" indicates identification of analyte is acceptable, reported value is an estimate; "U" indicates analyte not detected at or above reporting limit; "UJ" indicates analyte not detected at or above reporting limit, reporting limit is an estimate.

Permanent Leach Pad Ponds

The permanent leach pad area contains the permanent leach pad and three lined ponds. Leach/rinse solutions were routed from the permanent leach pad by collection ditches to the pregnant pond. Water from the pregnant pond was fed to the processing plant. The gold and silver were extracted from the water and the solution was emptied into the barren pond. Barren pond water was 'refreshed' with added cyanide and applied to the heap leach pile (Ref. 3, 9, 10, 14, 16, 17, 20).

Excess heap leach water from heavy rain events, etc., was collected in the rinse ponds. The diluted water in the rinse ponds was moved to the barren pond. From the barren pond, the water would be 'refreshed' and once again applied to the heap leach pile (Ref. 9, 10, 14, 16, 17).

Table 6	
Permanent Leach Pad Area Pond Capacities	
Pond	Maximum Pond Level (gallons)
Pregnant Pond	1.50×10^6
Rinse Pond	1.00×10^6
Barren Pond	6.86×10^6

Three surface water samples and one sediment sample were collected from the ponds in the Plant and Process area. Sample BH-006-SW/SE was collected from the rinse pond. Sample BH-007-SW was collected from the pregnant pond. Sample BH-008-SW was collected from the barren pond (Ref. 21, 22).

Table 7: Barite Hill/Nevada Goldfields
 Permanent Leach Pad Area Water Samples
 Analyzed for TAL Metals.
 All results in ug/kg Ref. 19

Analyte	BH-006-SW	BH-007-SW	BH-008-SW
Silver	15 U	19	15 U
Arsenic	76	140	81
Barium	15 U	15 U	15 U
Beryllium	9.0 U	9.0 U	9.0 U
Cadmium	2.7	1.2 U	2.8
Cobalt	200	290	200
Chromium	15 U	15 U	15 U
Copper	1200	5100	1200
Molybdenum	2100	2600	2100
Nickel	40	37	40
Lead	2.5 U	2.5 U	5.0 U
Antimony	7.6	11	7.7
Selenium	1200	1800	1200
Tin	94	98	90
Strontium	420	400	390
Titanium	15 U	15 U	15 U
Thallium	2.5 U	2.5 U	5.0 U
Vanadium	15 U	15 U	15 U
Yttrium	9.0 U	9.0 U	9.0 U
Zinc	130	32	120
Total Mercury	0.20 U	0.24	0.20 U
Aluminium	300 U	300 U	150 U
Manganese	350	140	330
Calcium	120	130	120
Magnesium	6	5.6	5.7
Iron	0.30 U	0.42	0.30 U
Sodium	1200 J	1200 J	1100 J
Potassium	28	30	27
Cyanide	48	1300	60 J

"J" indicates identification of analyte is acceptable, reported value is an estimate; "U" indicates analyte not detected at or above reporting limit; "UJ" indicates analyte not detected at or above reporting limit, reporting limit is an estimate.

Table 8: Barite Hill/Nevada Goldfields

Permanent Leach Pad Area Sediment Sample
 Analyzed for TAL Metals.
 All results in mg/kg

Analyte	BH-007-SE
Silver	60
Arsenic	160
Barium	32
Beryllium	5.0 U
Cadmium	6.8
Cobalt	190
Chromium	21 U
Copper	20000
Molybdenum	290
Nickel	76
Lead	5.9
Antimony	2.2
Selenium	1700
Tin	20 U
Strontium	28
Titanium	9.9 U
Thallium	0.25 U
Vanadium	20 U
Yttrium	24
Zinc	620
Total Mercury	2.8 A
Aluminium	3600
Manganese	83
Calcium	5400 J
Magnesium	500 U
Iron	8500
Sodium	6100
Potassium	2000 U
Cyanide	260

"A" indicates analyte analyzed in replicate.

Reported value is "average" of replicates; "J"

indicates identification of analyte is acceptable,

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 limit, reporting limit is an estimate.

Mineralized Zone

The Mineralized Zone refers to a 22-acre crusher/reusable pad area located roughly in the center of the site to the southeast of the Process Area. The crusher/reusable pad area was reclaimed in mid 1995. Periodic monitoring of stormwater runoff at NPDES Outfall 1 between 1995 and 1998 exhibited a depressed pH and elevated metal concentrations due to contact with sulfide-bearing soil and rock material (Ref. 3, 14, 23, 24).

The crusher area consisted of a crusher and agglomeration system that processed both oxide and sulfide ores mined from the Main and Rainsford Pits. Run-of-mine ore from a nearby stockpile was fed into the crusher where it was reduced to a minus one-inch size and then mixed with cement to produce a product suitable for leaching. The agglomerated ore was stacked on the leach pad using a rubber-tired conveyor system (Ref. 10, 12, 16, 17, 23).

The reusable leach pad covered approximately 7-acres and consisted of an asphalt-lined pad surrounded by asphalt berms. Agglomerated ore was stacked on the pad to a height of approximately 30 feet and was leached with a cyanide solution in a closed-circuit process to recover gold and silver values. After leaching, the ore was rinsed with water and transported to the clay-lined Area C Landfill for disposal (Ref. 3, 10, 12, 16, 17, 23).

Reclamation included the excavation of the asphalt liner, which was placed in the permanent leach pad. The area was harrowed and reseeded (Ref. 23).

During SCDHEC's visits to the site on December 8, 2003 and September 26, 2004 sulfide bearing soils and rock material were visibly exposed in the Mineralized Zone. Vegetative cover was poor to nonexistent (Ref. 22).

The Mineralized Zone was screened with an Innov-X Systems XL-440 portable XRF during the September 26, 2004 Sampling event. Based on the screening results the locations of three soil samples were determined (Ref. 21, 22).

Table 9: Barite Hill/Nevada Goldfields Mineralized Zone Soil Samples. Analyzed for TAL Metals. All results in mg/kg (Ref. 19)

Analyte	BH-019-SO	BH-020-SO	BH-021-SO
Silver	1.5 A	0.68	1.3
Arsenic	39 AJ	5.3	56
Barium	870 AJ	860	1100
Beryllium	0.30 U	0.30 U	0.60 U
Cadmium	0.12 U	0.43	0.12 U
Cobalt	2.6 AJ	1.3	1.0 U
Chromium	8.9 A	5.7	6.6
Copper	96 AJ	78	230
Molybdenum	0.80 AJ	0.50 U	1.0 U
Nickel	1.0 U	2.0 U	2.0 U
Lead	200 A	28	80
Antimony	1.4 AJ	0.25 U	1
Selenium	1.3 AJ	1	1.3
Tin	1.5 U	1.5 U	3.0 U
Strontium	8.3 A	9.7	9.3
Titanium	55 A	37	55
Thallium	0.25 U	0.25 U	0.25 U
Vanadium	33 A	31	24
Yttrium	0.46 A	0.67	0.78
Zinc	12 A	16	23
Total Mercury	0.14	0.098 U	0.098 U
Aluminium	3300 A	3100	2400
Manganese	92 AJ	32	27 U
Calcium	530 AJ	180J	59 J
Magnesium	490 AJ	200	50 U
Iron	31000 AJ	23000 J	3200 J
Sodium	100 U	220	200 U
Potassium	180 A	150	200 U
Cyanide	0.16 UJ	43	0.43 UJ

"A" indicates analyte analyzed in replicate. Reported value is "average" of replicates; "J" indicates identification of analyte is acceptable, reported value is an estimate; "U" indicates analyte not detected at or above reporting limit; "UJ" indicates analyte not detected at or above reporting limit, reporting limit is an estimate.

VI. GROUNDWATER

The Barite Hill/Nevada Goldfields site is located approximately 3 miles south of McCormick in McCormick County. The majority of the population within a 4-mile radius of the site is provided potable water by McCormick County Water and Sewer. McCormick County Water and Sewer obtains water from Strom Thurmond Lake near the Hawes Creek discharge point. McCormick County Water and Sewer serves approximately 4,000 taps (Ref. 3, 9, 25).

Three zones of groundwater have been identified underlying the site. The zones are hydraulically connected; therefore, no isolated or perched water table conditions are expected to exist below the site. The first and upper zone exists within the saprolitic materials (extremely degraded and weathered bedrock and colluvial soils with bedrock-like structures and fractures. The second zone is within the fracture system of the underlying weathered bedrock. The third zone is within the competent bedrock designated as the Igneous and Metamorphic Bedrock Aquifer System (Ref. 25, 26).

All three zones exhibit similar horizontal gradients in a southerly direction consistent with the relief of the topographic expression. The hydraulic conductivity from one zone to the next is relatively different and is a function of the material. The average hydraulic conductivity as measured in the field within the saprolitic material is about 0.05 ft/day (Ref. 25, 26).

Based on field observations (DP Engineering et al. 1990), the hydraulic conductivity of the upper portion of the saprolitic material and colluvial clay soil covering the site may be as much as one or two orders of magnitude lower. This is because the secondary features of the lower saprolitic material (i.e., fractures, joints and bedding planes) that control hydraulic conductivity are less prominent or nonexistent near surface materials. Therefore, hydraulic conductivity is controlled primarily flow patterns (i.e., through the pore structure of the material) rather than the 'open' structures. Due to fine-grained particle size and clayey consistency of the surface materials, the hydraulic conductivity would be lower in areas where the material has been compacted (Ref. 12, 25, 26).

The middle zone (weathered rock) has an average hydraulic conductivity of 0.18 ft/day. This increased value is probably a result of more open fracture and joint patterns in the bedrock. The more 'open' secondary fractures are likely the result of oxidation and leaching out of joint and fracture fillers and relief of confining pressures in the near surface rock (Ref. 12, 25, 26).

The lower zone of competent bedrock exhibited a conductivity of 0.019 ft/day and 0.09 ft/day in the two boreholes used in the field tests (Ref. 12, 25, 26).

The vertical gradient in the lower groundwater zone is upward to the intermediate zone. The upper bedrock zone or intermediate groundwater zone exhibits a higher hydraulic conductivity than the saprolitic material, thus acting as a receptor and interrupting the upward gradient to the surface. In

turn, the gradient from the saprolitic material to the upper bedrock is downward (Ref. 12, 25, 26).

There has been previous environmental sampling and groundwater monitoring at the site. No significant detections of elevated metals or hazardous substances have been reported. Because of the remoteness of the site, and the lack of wells used for drinking water, no groundwater samples were taken for the SI investigation (Ref. 3, 21, 24).

VI. SURFACE WATER PATHWAY

A. Regional Characteristics

Strom Thurmond Lake on the Savannah River is approximately 3 miles down gradient of the site. The most significant surface drainages at the mine site are two tributaries to Hawe Creek. One perennial tributary runs approximately 4,000 feet along the north side of the mine site. The second tributary, which appears to be ephemeral, starts on the south side of the site and drains to the west for approximately 2,000 feet before turning northward and flowing another 3,000 feet along the west side the mine site. The confluence of the two tributaries is about 200 feet northwest of the overall property boundaries. From here, the unnamed tributary flows about 800 feet into Hawe Creek. Hawe Creek runs about 3 river-miles before emptying into Strom Thurmond Lake on the Savannah River. The Savannah River completes the 15-mile Target Distance Limit (TDL) (Ref. 3, 9, 12, 14).

The Barite Hill/Nevada Goldfields site operated two outfalls to nearby surface water under NPDES Permit No. SC0043401. The primary effluent was surface water runoff from the site, including mine drainage from rinsed ore bodies. The Barite Hill/Nevada Goldfields site exceeded the water quality standards set in NPDES Permit No. SC0043401 numerous times as detailed in SCDHEC NOV 8-25-95, 6-27-96, 10-30-1996, and 3-11-1997 (Ref. 14, 24).

The site was abandoned in the summer of 1999. No surface water run-on or runoff controls have been maintained since July of 1999. Severe erosion has been noted throughout the site with runoff sediments entering a wetlands area at the Outfall 1 probably point of entry. It is likely that erosion channels have breached the cap of the waste dump and permanent leach pad (Ref. 6, 7, 14, 21).

There is visual evidence indicating the process area ponds and leach pad ponds have overflowed their banks on numerous occasions (Ref. 21).

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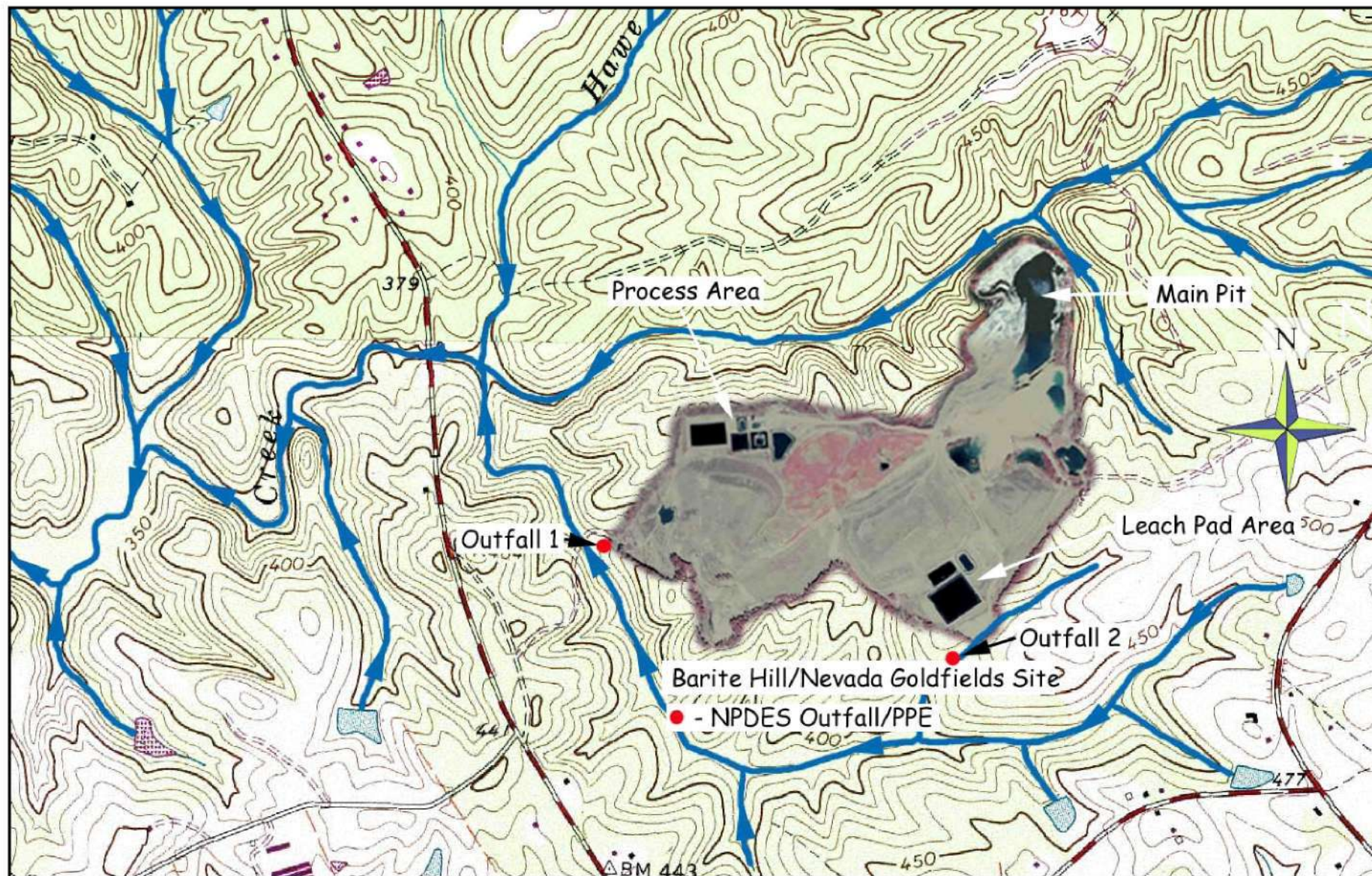


Figure 2 – Surface Water Pathway for Barite Hill/Nevada Goldfields Site

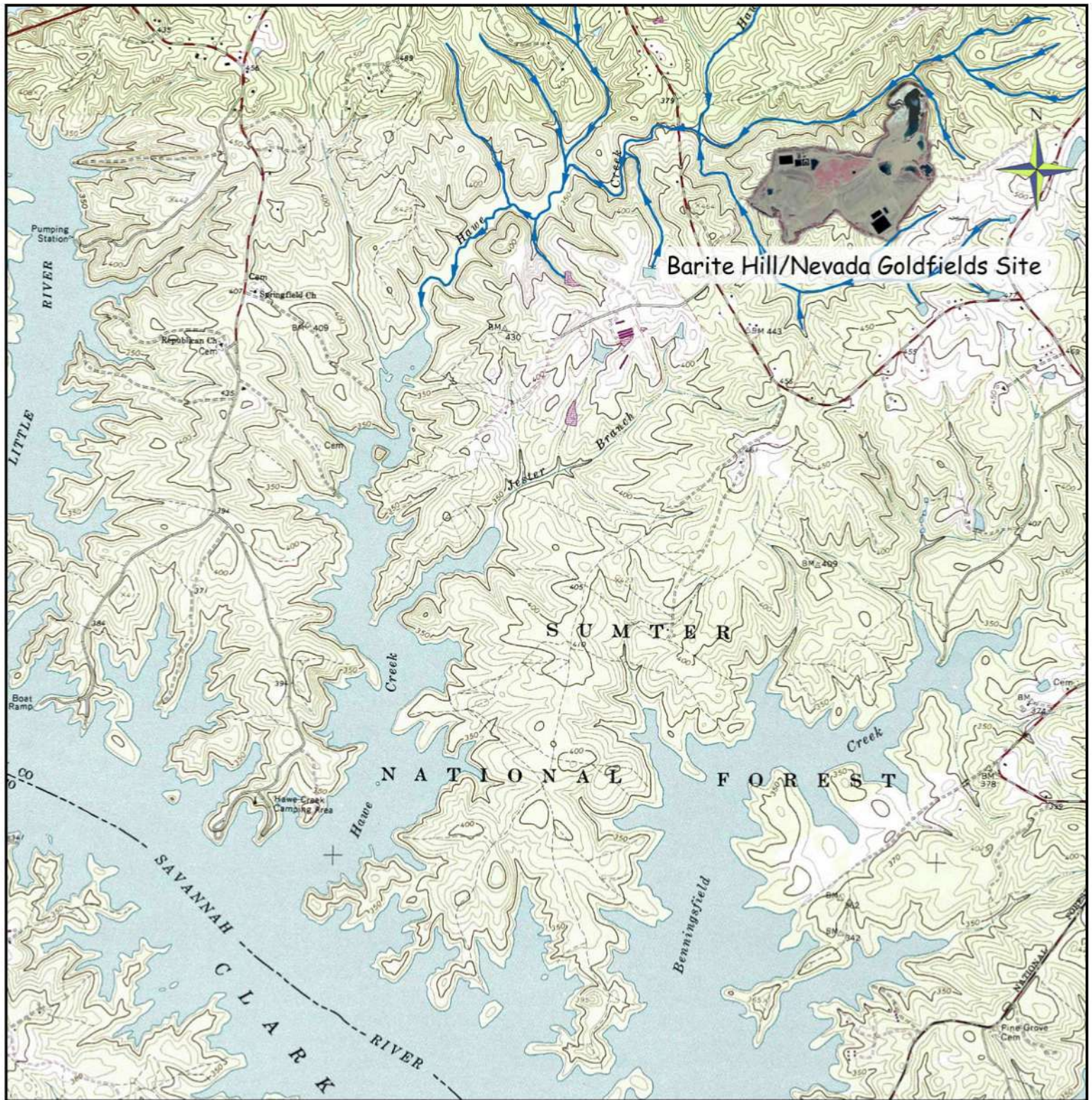


Figure 3 – Surface Water Pathway for Barite Hill/Nevada Goldfields Site

B. Surface Water Use

The McCormick County Water and Sewer public water supply intake is near, but upgradient, of Hawe Creek's outfall into Strom Thurmond Lake. Fishing and swimming take place in portions of the Hawe Creek and in Strom Thurmond Lake. There are approximately 3 acres of wetlands on west side of the site along the unnamed tributary of Hawe Creek. Runoff from the site empties directly into these wetlands at NPDES Outfall 1 (Ref. 3, 27, 28).

C. Surface Water Impact

Macroinvertebrate studies have been conducted on a bi-annual basis at the site from 1992 to 1998 as a requirement of the NPDES permit. Studies by a consultant have indicated elevated concentrations of metals discharging to the 001 Outfall receiving stream resulting in a reduction of habitat in the tributary near the outfall pipe. Reports by the consultant filed in August 1994 and March 1995 indicated significant impact to the tributary by mining operations, which lead to the elimination of fish and most macroinvertebrates. The March 1995 report indicated impacts from Outfall 001 had progressed downstream in the tributary to near its confluence with Hawe Creek. The timing of these events coincides with the violations resulting from the retention pond overflow and seeps during mid-to-late 1994 (Ref. 14, 29).

A control/background water and sediment samples was collected upgradient of the site from each of the unnamed tributaries and from Hawe Creek. Four water and sediment samples were collected from the wetlands area to the west of the site. One water and sediment sample was collected from northern unnamed tributary near the Main Pit's northern wall. One sediment sample was collected from the NPDES outfall 002 to the south of the site and another at the NPDES Outfall 001 to the west of the site. Two soil samples were collected from the unlined collection basin to the west of the process area ponds. One soil sample was collected from plant site and process area runoff pathway leading to the western NPDES outfall. One sediment sample was collected at the southern edge of the permanent leach pad's rinse pond in an area of visible staining from the pond overflowing its banks. One sediment sample was collected at the western edge of the permanent leach pad's pregnant pond from a visible runoff pathway from the pond overflowing its banks. The samples were used to assess the potential for hazardous substances in the wetlands and the migration of hazardous substances from the site to Hawe Creek (Ref. 14, 21, 22).

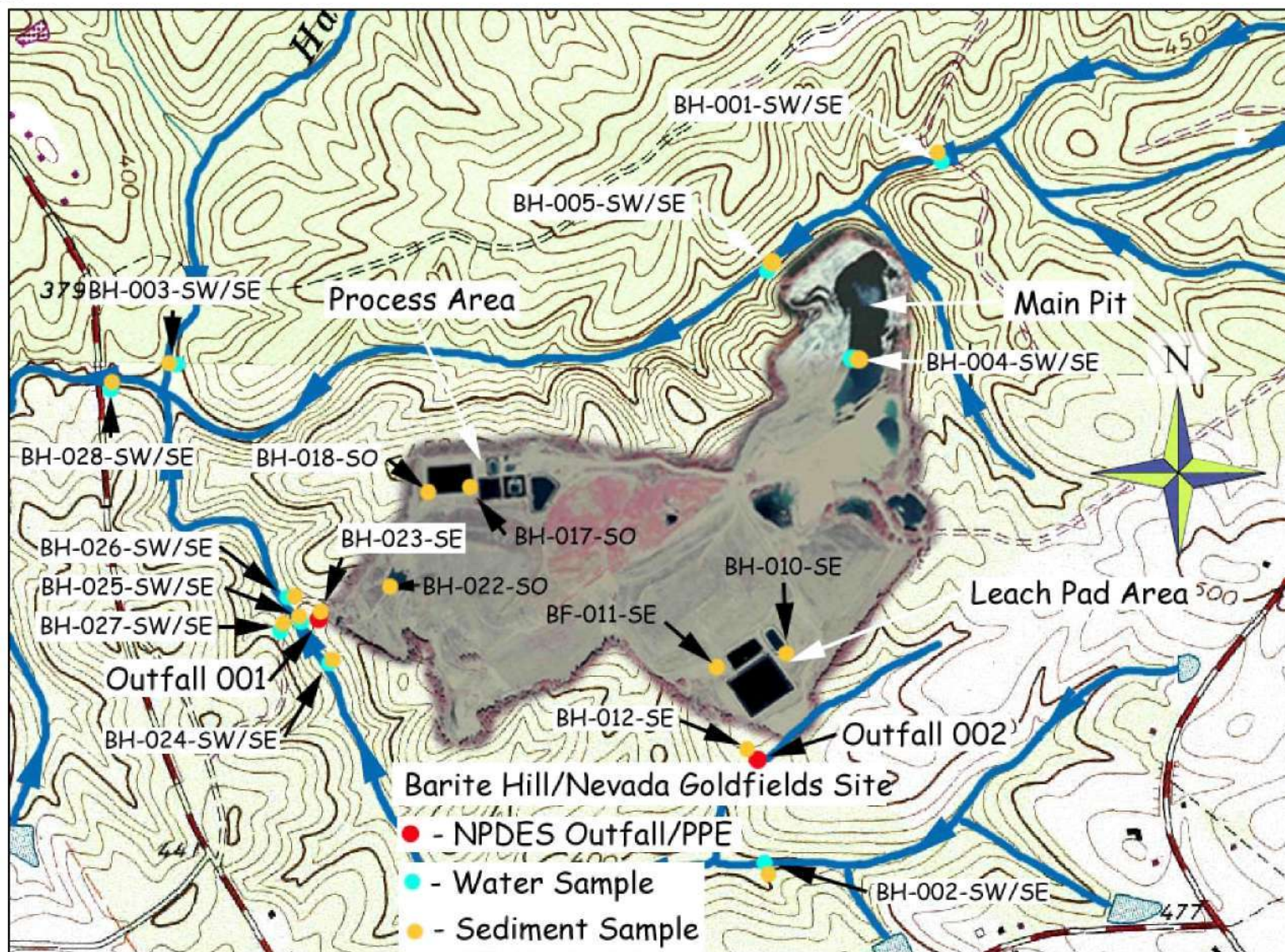


Figure 4 - Surface Water Pathway Sampling Map

Table 10: Barite Hill/Nevada Goldfields Surface Water Pathway Soil/Sediment Samples. Analyzed for TAL Metals. All results in mg/kg (Ref. 19)

Analyte	BH-002-SE	BH-012-SE	BH-022-SO	BH-023-SE	BH-024-SE	BH-025-SE	BH-026-SE	BH-027-SE	BH-003-SE	BH-028-SE
	(Background)								(Background for BH-0028-SE)	
Silver	2.0 U	0.99 U	1.7	0.99 U	1.7	1.10 U	1.0 U	0.82	0.99 U	0.62
Arsenic	0.46	1.7	7.3	7.9	8.5	5.7	5.2	1.6	2.1	1.3
Barium	72	95	1200	1900	1800	2100	1700	500	180	100
Beryllium	1.3	0.35	0.60 U	0.60 U	0.60 U	0.60 U	0.60 U	0.35	0.79	0.62
Cadmium	0.17 U	0.2	0.4	0.14 U	0.17 U	0.20 U	0.4	1.4	0.22 U	0.15 U
Cobalt	44	7.4	1.4	3.3	2	2.4	4.8	17	30	16
Chromium	140	18	19	15	17	13	10	23	34	30
Copper	14	55	250	110	130	100	180	190	26	24
Molybdenum	1.0 U	0.69	1.0 U	1.1	0.99 U	1.0 U	1.0 U	1.3	0.50 U	0.50 U
Nickel	6.5	1.9	4.0 U	2.0 U	2.0 U	2.0 U	4.0 U	5	9.3	7.1
Lead	26	22	76	130	210	110	64	26	17	14
Antimony	0.25 U	0.25 U	0.32	0.68	0.5	0.51	0.25 U	0.25 U	0.25 U	0.25 U
Selenium	0.50 U	1.4	0.50 U	0.50 U	0.50 U	0.50 U	0.61	1.9	0.50 U	0.50 U
Tin	2.0 U	0.99 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	1.5 U	0.99 U	1.5 U
Strontium	10	4.6	8.4	6.5	9.9	8.5	7.2	15	17	10
Titanium	160	39	120	90	100	67	61	99	98	88
Thallium	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Vanadium	220	49	87	49	59	35	40	64	93	69
Yttrium	7.5	3.8	3	1.1	2	1.5	3.2	8.7	12	9.4
Zinc	32	19	24	24	22	22	25	130	46	33
Total Mercury	0.096 U	0.097 U	0.073 A	0.050 U	0.059	0.053	0.066	0.078	0.099 U	0.048 U
Aluminium	13000	5900	7200	4600	5500	3900	6200	8000	11000	9700
Manganese	1800	490	130	93	130	220	230	800	3500	1600
Calcium	1300 J	450 J	180 J	58 J	120 J	160 J	510 J	2000 U	2400 J	1700 J
Magnesium	2300	580	250	87	210	360	500	2400	3500	3300
Iron	95000	31000	36000 J	45000 J	41000 J	38000 J	26000 J	22000 J	46000	39000 J
Sodium	400 U	200 U	200 U	200 U	200 U	200 U	200 U	100 U	200 U	100 U
Potassium	200 U	99 U	200 U	200 U	200 U	200 U	200 U	130	260	160
Cyanide	Not Analyzed	0.81 UJ	0.20 UJ	3.4 U	3.6 U	0.34 UJ	4.3 U	11 U	0.32 UJ	3.2 U

Values shown in bold indicate > 3 times background; "A" indicates analyte analyzed in replicate. Reported value is "average" of replicates; "J" indicates identification of analyte is acceptable, reported value is an estimate; "U" indicates analyte not detected at or above reporting limit; "UJ" indicates analyte not detected at or above reporting limit, reporting limit is an estimate.

Table 10: Continued. All results in mg/kg

Analyte (Background)	BH-001-SE	BH-005-SE
Silver	2.0 U	0.99 U
Arsenic	4.1 AJ	6.5
Barium	1600 A	820
Beryllium	0.84 A	0.42
Cadmium	0.24 U	1.9
Cobalt	24 A	16
Chromium	43 A	24
Copper	49 A	280
Molybdenum	1.0 UJ	0.76
Nickel	6.3 A	2.8
Lead	150 A	49
Antimony	0.29 UJ	0.35
Selenium	0.50 UJ	0.50 U
Tin	2.0 U	0.99 U
Strontium	8.8 A	5.6
Titanium	67 AJ	80
Thallium	0.25 U	0.25 U
Vanadium	97 A	55
Yttrium	5.0 A	2.9
Zinc	100 A	10
Total Mercury	0.094 U	0.095 U
Aluminium	6900 A	5100
Manganese	1500 A	880
Calcium	550 AJ	260 J
Magnesium	510 A	690
Iron	79000 A	42000
Sodium	400 U	200 U
Potassium	200 U	200
Cyanide	0.18 UJ	0.01 UJ

Values shown in bold indicate > 3 times background; "A" indicates analyte analyzed in replicate. Reported value is "average" of replicates; "J" indicates identification of analyte is acceptable, reported value is an estimate; "U" indicates analyte not detected at or above reporting limit; "UJ" indicates analyte not detected at or above reporting limit, reporting limit is an estimate.

Table 11: Barite Hill/Nevada Goldfields Surface Water Pathway Samples. Analyzed for TAL Metals. All results in ug/kg (Ref. 19)

Analyte	BH-002-SW	BH-024-SW	BH-025-SW	BH-026-SW	BH-027-SW	BH-028-SW
Silver	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Arsenic	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Barium	35	130 A	150	150	170	24
Beryllium	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
Cadmium	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Cobalt	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chromium	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Copper	5.0 U	10 A	13	12	15	5.0 U
Molybdenum	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Nickel	10 U	10 U	10 U	10 U	10 U	10 U
Lead	2.5 U	4.7	4.8	5.2	6.3	2.5 U
Antimony	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Selenium	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Tin	18	15 U	16	15 U	15 U	15 U
Strontium	210	140 A	150	150	150	86
Titanium	5.0 U	10 A	14	12	16	5.0 U
Thallium	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Vanadium	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Yttrium	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
Zinc	10 U	10 U	10 U	10 U	10 U	10 U
Total Mercury	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Aluminium	50 U	740 A	1000	970	1300	320
Manganese	22	2300 A	2600	2500	2500	750
Calcium	43	21 A	22	22	22	16
Magnesium	27	14 A	15	15	15	7.6
Iron	0.10 U	2.6 A	4.3	3.4	3.7	1.8
Sodium	23	22 A	23	23	23	8.5
Potassium	1.5	2.3 A	2.4	2.4	2.5	3.8
Cyanide	10 U	10 U	10 U	10 U	10 U	10 U

Values shown in bold indicate > 3 times background; "A" indicates analyte analyzed in replicate. Reported value is "average" of replicates; "J" indicates identification of analyte is acceptable, reported value is an estimate; "U" indicates analyte not detected at or above reporting limit; "UU" indicates analyte not detected at or above reporting limit, reporting limit is an estimate.

VII. SOIL EXPOSURE PATHWAY

The Barite Hill/Nevada Goldfields site is located approximately 3 miles south of McCormick, South Carolina between US 378 and US 221 on the northern side of Road 30 in McCormick County, South Carolina. The mine site is relatively remote; there are no buildings, homes, or commercial buildings within 0.5 miles of the site's boundaries. Because of the remoteness of the site, no soil samples were proposed for the SI investigation (Ref. 3, 9, 10, 21).

VIII. CONCLUSION AND RECOMMENDATIONS

Before Nevada Goldfields ceased reclamation activities at the site on July 7 1999, the pH of the water in the Main Pit was raised to 11 standard units through the addition of lime. During a SCDHEC site visit on November 13, 2003, the water in the Main Pit was determined to have a pH of between 2 to 2.2 standard units. The condition of the Main Pit at the Barite Hill/Nevada Goldfields site is of the utmost concern. Because of sulfide waste rock, the water quality of the pit will adversely impact the groundwater and the surface waters surrounding the site.

The Main Pit represents the greatest potential for adverse impacts to the environment surrounding the Barite Hill/Nevada Goldfields site. However, there are other areas of concern: 1) process waters have not been treated to acceptable qualities for discharge; 2) construction of wetlands to act as passive treatment for leachate drainage from the capped leach pads and industrial waste landfills was not implemented allowing untreated leachate to reach surface water bodies; 3) concrete buildings that formerly housed the gold processing plant and associated process ponds have not been properly closed out; 4) proper maintenance of clay caps, grasslands, run on and runoff controls have been discontinued; 6) no monitoring of groundwater quality at the site; and 7) no monitoring of process water being discharged to the surface water bodies surrounding the site.

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